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Method and Device for Producing Polycapillary Elements

The invention relates to a method for continuous production through extrusion of polycapillary bodies for processing and use as writing tips for felt-tip pens, capillographs and similar, and also to a device for implementing the method.

Various methods are already known for producing writing tips which, on account of their capillary composition, can draw in the ink of a container and apply it to the paper with the lowest pressure. The writing tips produced according to this method are either too expensive, so that their use is limited only to felt-tip pens and capillographs of the best quality or, however, their quality is not sufficient for certain purposes, whereby they also end up being uneconomical as the remaining ink of the filler is not used in the event of premature impairment of the tip.

On the other hand, for the methods known to date according to which writing tips of the best quality are produced, complex techniques or machines are necessary such as e.g. fibre extrusion presses, subsequent sticking and finally pointing or extrusion of hollow tubular elements in order to achieve capillarity, after which each individual tip must be pointed.

It is an object of the present invention to create a new method and also a device for implementing the method, by means of which more economical mass production of high quality is possible.

The method according to the invention is characterised in that by means of an extrusion press which is known in itself polymer, thermoplastic or thermal hardening material is extruded through a mouth piece, of which the outlet cross-section is greater than that of the end product and is simultaneously characterised in that a gas or air is blown through a multitude of thin tubes or nozzles in the extrusion direction in a region lying between the start of the melting zone and the start of the cooling zone and in that the extruded tubular element is stretched by means of a drawing device with a reduction in its cross-section to the desired end dimension and with a reduction

of the hollow spaces produced through the air blown in to a capillary dimension, and is subsequently wound.

Cooling rings for air or water cooling are thereby provided between the outlet of the extruded tubular element at the nozzle mouth piece and the winding device, by means of which cooling rings the reduction of the extruded tubular element, the cross-section of the tubular element and also the cross-section of the individual capillary channels in the tubular element can be controlled.

Each individual one of the thin tubes, through which air is blown, forms a hollow channel of round cross-section inside the extruded tubular element. Through the reduction and cooling, a tubular element is produced that is held together and internally comprises capillary longitudinal channels, the number of which is equal to or less than the number of the thin tubes through which air is blown. Elements of a suitable length can then be cut from this extruded tubular element and used as writing tips for felt-tip pens and capillographs.

Further features of the invention can be derived from the claims 2 to 5.

The invention is explained in greater detail below by reference to the drawings, in which:

Fig. 1 shows, schematically, an arrangement for implementing the method according to the invention,

Fig. 2 shows an extrusion nozzle head in cross-section,

Figs. 3 and 4
show cross-sections of the extruded tubular element on an enlarged scale,

Fig. 5 shows a writing tip in longitudinal section.

Fig. 1 shows the devices provided for implementing the individual method steps . The polymer material is melted and homogenised by the extrusion press 1 and is extruded in the molten state in the form of a tube through an extrusion nozzle 2, whereby air is simultaneously blown in by means of a device 3 which comprises a distribution chamber 13 and a bundle of thin tubes 15. The extruded tubular element runs through

two air cooling rings 4 and 5, of which the inner walls are provided with holes, through which blowing air is conducted to the extruded tubular element. By means of a drawing device 6 the still plastic tubular element is reduced to the desired cross-section. By means of a water cooling ring 7 the end cooling is realised. A winding device 8 is arranged behind the drawing device 6, which winding device winds the extruded tubular element. The cutting of the pieces used for each writing tip from the wound tubular element and the pointing thereof is realised in the conventional way.

The extrusion head shown in Fig. 2 comprises a chamber 9 through which the molten material flows into the extrusion nozzle 11, of which the outlet cross-section 10 has a larger diameter than the extruded end product. In an insert having the form of a double cone there is an air distribution chamber 13 which is in connection with a compressed air line 12. A bundle of thin tubes 15 with a small passage cross-section is fixed in the nozzle side end 14 of the distribution chamber 13, said tubes 15 extending as far as the outlet plane 10 of the extrusion nozzle 11. It can be seen that the bundle of tubes 15 has an overall smaller diameter than the extrusion bore of the extrusion nozzle 11.

Fig. 3 shows the cross-section of the extruded tubular element produced at the outlet 10 of the extrusion nozzle 11 with the channels 16 formed through the air blown through the tube bundle 15.

Fig. 4 shows a cross-section of the polycapillary extruded tubular element in its end state which has a smaller cross-section as a result of the reduction by means of the drawing device 6 and of which the channels 17 are each reduced to a diameter with suitable capillary properties. Fig. 3 and Fig. 4 are not true to scale illustrations as the measurements in the actual size cannot be easily illustrated. The extruded tubular element cross-section is in any case considerably smaller after reduction than the outlet cross-section of the extrusion nozzle 1.

The particularly important advantage can be seen in that with this method and the device shown for example in Fig. 2 a stable body that is solid in itself is produced, which on account of its solid outer ring facilitates perfect assembly and wherein the pointing is directly possible without damage to the capillary inner zone. The conicity

of the capillary inner part can also advantageously be selected so that the writing line produced with the writing tip always has a regular width irrespectively of the inclination of the tip during writing.

Fig. 5 shows a longitudinal section for a writing tip which reproduces one of the numerous possibilities for the shape of the writing tip. The fixed solid ring part 18 which surrounds the capillary channels 17 facilitates a precise adaptation of the writing tip and fixed embedment in a holding vessel and also facilitates the pointing without damage to the capillary zone in the region of the outer part 19. As the capillary tubes are limited to the central cross-sectional zone and are only present in the region of the tip 20 the angle of inclination of this writing tip no longer has a changing effect upon the thickness of the writing line during writing.

The measurement ratios of the solid crown, the isolated capillary tubes, the walls between the capillary tubes and the whole of the capillary tubes and also their form can be directly changed and adapted to the respective purpose.

The method according to the invention facilitates the production of polycapillary elements with different properties, for which it is merely necessary to vary the individual factors of the production process correspondingly. The polymer material used and its melting properties, the temperature and the through-flow during extrusion, the cross-sectional form of the extrusion nozzle and its dimensions, the arrangement of the tube bundle for blowing in the air, the number and the inner diameter of these tubes, the strength of the air flow or the type of gas blown in, the thickness of the adjacent inner walls of the capillary tubes and the outer ring surrounding them, the drawing speed, the drawing ratio, etc., are factors which can be selected in dependence upon or independently of each other in order to achieve different use properties for the polycapillary end product obtained.

It can directly be seen from the drawings that with the method according to the invention and the device according to the invention a simple and rational production of polycapillary extrudates is facilitated which can be implemented in practice without difficulties and guarantees the production of a relatively cheap product. In particular from the viewpoint of mass production the economic advantage is significant.

Claims

1. Method for continuous production through extrusion of polycapillary bodies for processing and use as writing tips for felt-tip pens, capillographs and similar, characterised in that by means of an extrusion press known in itself, polymer, thermoplastic or thermal hardening material is extruded through a mouth piece, of which the outlet cross-section is larger than that of the end product and in that a gas or air is simultaneously blown in through a multitude of thin tubes or nozzles in the extrusion direction in a region lying between the start of the melting zone and the start of the cooling zone, and in that the extruded tubular element is extended by means of a drawing device reducing its cross-section to the desired end dimension and with reduction of the hollow spaces produced through the air blown in to a capillary dimension, and is subsequently wound.

2. Method according to claim 1, characterised in that the number of thin tubes or nozzles through which a gas or air is blown over the whole length of the extruded tubular element in the region of the extrusion nozzle is equal to or less than the number of the capillary channels to be produced in the extruded tubular element.

3. Method according to claim 1 or 2, characterised in that cooling of the extruded material is realised between the outlet of the extruded polymer material and the winding of the extruded continuous polycapillary tubular element in order to achieve the state which is most suitable for processing, so that the desired properties for the continuous polycapillary element are always achieved.

4. Nozzle head for implementing the method according to claim 1 and 2, characterised in that in the outlet area (10) of the extrusion nozzle (11) a bundle of thin tubes (15) is arranged, of which the profile is equal to or smaller than that of the outlet opening of the extrusion nozzle (11) which is connected via a distribution bore (13) to a compressed air line (12), whereby the tubes (15) are so long that the air blowing can be realised at any point between the zone in which the polymer material begins to melt and the zone in which the cooling of the extruded material begins.

5. Polycapillary writing tip from an element produced according to the method of claims 1 to 3 which is pointed suitably in length, characterised in that it comprises capillary longitudinal openings (16, 17) of rounded off cross-section which are arranged in its central cross-sectional zone and surrounded by a solid annular wall (18) in such a way that it consists of one element.